CMER WORK PLAN
2003

Prepared by:

COOPERATIVE MONITORING, EVALUATION AND RESEARCH COMMITTEE

June 6, 2003

Comments or questions contact:

Geoff McNaughton, Adaptive Management Administrator
(geoffrey.mcnaughton@wadnr.gov)

Timothy Quinn, CMER Co-chairman
(quinntq@dfw.wa.gov)

Douglas Martin, CMER Co-chairman
(martin1696@aol.com)

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 BACKGROUND ON ADAPTIVE MANAGEMENT

The State Forest Practices Board (FPB) has adopted an adaptive management program in concurrence with the Forest and Fish Report legislation (State Forest Practices Rules WAC *222-12-045). The purpose of this program is to:

> "…provide science-based recommendations and technical information to assist the board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives."

To provide the science needed to support adaptive management, the FPB established the Cooperative Monitoring, Evaluation and Research Committee (CMER). The FPB empowered CMER to implement, research, effectiveness, and validation monitoring per guidelines set by the Forest and Fish Report (FFR). CMER is organized into a series of Scientific Advisory Groups (SAGs) that are responsible for designing and implementing the research and monitoring program.

1.2 PURPOSE AND OBJECTIVES OF THE CMER WORK PLAN

The goal of this work plan is to provide an integrated strategy for how CMER will monitor the effectiveness of the Forest and Fish rules to protect and maintain aquatic resources. The work plan is intended to inform CMER participants, policy constituents, and the interested public in CMER's activities. The plan is a living document that will be revised in response to research findings, changes in policy objectives, and funding. Currently, we anticipate there will be annual revisions to the work plan.

The work plan goal will be met by achieving six objectives:

1. Identifying critical research and monitoring questions (a process started in appendix LI and L2, FFR Report) that are pertinent to evaluating rule effectiveness
2. Organizing these questions into coherent program groupings
3. Assessing the risk and scientific uncertainty for each program
4. Developing an integrated strategy for accomplishing the work
5. Prioritizing programs/projects for implementation
6. Developing budget estimates and timelines for implementation.

1.3 ORGANIZATION OF THE WORK PLAN DOCUMENT

The work plan is organized in a hierarchical format. FFR "rule" groups form the highest level, programs occur within rule groups, and projects are defined within programs (e.g., Table 2). Functionally, research and monitoring questions are identified at the rule group level and are assigned to programs (topic groups). Then projects are developed with the programs for implementation of monitoring. In the remainder of this section we further define the rule groups and programs, and introduce the monitoring task framework that is being used by CMER. Sections 2 and 3 provide detailed descriptions of the Rule Groups and Programs, respectively. Section 4 describes how CMER used an assessment of risk and scientific uncertainty to prioritize and rank the monitoring programs.

1.3.1 Rule Group Structure and Definition

A rule group is a set of forest practices rules relating either to a particular resource, such as wetlands, or fish-bearing streams, or to a particular type of forest practice, such as roads construction and maintenance.

The rule groups are mostly organized along the lines of the appendices in the FFR, including:

1. Riparian Strategy (FFR, Appendix B) which includes five sub-groups:
   a. Stream Typing
   b. Type N Streams
   c. Type F streams
   d. Bull trout
   e. Channel Migration Zones (CMZ)
2. Unstable Slopes (FFR, Appendix C)
3. Roads (FFR, Appendix D)
4. Fish Passage (included in FFR, Appendix D, Roads)
5. Pesticides (FFR, Appendix E)
6. Wetland Protection (FFR, Appendix F)
7. Wildlife

1.3.2 Program Structure and Definition

A program is a combination of one or more projects that is designed to address a series of related scientific questions for a specific rule group. CMER organized all critical questions and issues into one or more research/monitoring programs. A description of each program including the purpose and objectives of the program and the strategy for accomplishing the work in presented in Section 2.

1.3.3 Task Descriptions

CMER defined several task categories to facilitate effectiveness monitoring over different spatial and temporal scales. This integrated approach includes an effectiveness monitoring task to evaluate prescription effectiveness at the site scale; an extensive monitoring task to evaluate status and trends in resource condition indicators across FFR lands; and, the intensive monitoring task to measure watershed-scale monitoring of causal relationships and cumulative effects. CMER also defined a rule implementation tool task to coordinate the development of scientific tools necessary for implementing the rule(s). CMER collaborates with the DNR on designing programs for rule implementation tools.

A more detailed description of these tasks follows. The rationale for this integrated monitoring approach is described in the Monitoring Design Team (MDT) Report.

1.3.4 Effectiveness/Validation Monitoring

Effectiveness monitoring/validation projects are designed to evaluate the performance of the prescriptions in achieving resource goals and objectives. Effectiveness monitoring may include several related projects such as research tool development and validation, pilot study, target

identification, and effectiveness monitoring projects. Effectiveness monitoring differs from the other approaches in that it is directed at prescription effectiveness at the site-scale.

1.3.5 Extensive Monitoring

Extensive monitoring evaluates the current status and future trends of key watershed input processes and habitat conditions across FFR lands statewide. Extensive monitoring is a statewide assessment of the effectiveness of FFR rules to attain specific performance targets across FFR lands. This is different from prescription effectiveness monitoring, which evaluates the effect of specific prescriptions at the site scale. Extensive monitoring is designed to provide annual report-card-type measures of rule effectiveness (i.e., do we meet the performance targets or how much have we improved over time) that can be used to determine if progress is consistent with expectations.

1.3.6 Intensive Monitoring

Intensive monitoring is watershed-scale monitoring that is designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and the biological effects of FFR rules on aquatic resources. The evaluation of cumulative effects from multiple management actions on a system requires an understanding of how individual actions influence a site and how those responses propagate through the system. This understanding will enable the effectiveness-evaluation of management practices applied at multiple locations over time. This sophisticated level of understanding can only be achieved with an intensive, integrated, monitoring effort. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how system biology responds to these habitat changes. Several potential intensive monitoring topics have been identified, and CMER is currently scoping critical questions that need to be addressed by an integrated intensive monitoring program

1.3.7 Rule Implementation Tool Development in cooperation with DNR

Rule implementation tool development includes efforts to develop, refine or validate tools used to implement the rules. Typical projects include the development, testing, and refinement of field protocols or models that would be used to identify or delineate landscape features that require FFR prescriptions. For example, the Last Fish Model will be used to predict the distribution of fish habitat in headwater streams. The presence or absence of fish habitat is the key resource concern that drives implementation of riparian buffer prescriptions. Other projects consist of studies designed to verify performance targets developed during FFR negotiations, such as the DFC basal area targets.

2.0 RULE GROUP DESCRIPTIONS AND MONITORING STRATEGIES

This section provides a rule group summary, rationale, strategy, and list of programs. The rule summary briefly describes the intent of the rule, the rationale identifies scientific questions related to those rules, and the strategy organizes those questions into programs and task categories.

2.1 RIPARIAN STRATEGY

The riparian strategy description is broken into five subgroups because of the complexity of this rule group. The subgroups are: the stream typing rule group (Type F/N delineation), the Type N rule group (non-fish-bearing streams), the Type F rule group, the Bull Trout rule group, and the Channel Migration Zone Rule Group. Each group is discussed separately below.

2.2 STREAM TYPING RULE GROUP

The FFR recommends adoption of rules by the forest practices board delineating waters of the state into three categories, Type S Waters, Type F waters and Type N waters. Distinguishing the upper limits of Type F (or S) waters is particularly important, because there are differences in the aquatic resources of concern, the management strategies and the prescriptions applied, depending on whether or not the stream provides fish habitat.

2.2.1 Rule Summary

Currently, stream typing is based on a complicated set of physical and beneficial use criteria according to guidance in the forest practice rules. Due to questions about the accuracy of this system, the FFR report recommends development of a statewide stream type map using a multi-parameter, field verified, GIS logistic regression model to identify the upper extent of Type F streams.

2.2.2 Strategy and Rationale

The FFR report provides a clear rationale and guidance for a strategy related to the stream typing system. The FFR report indicates that the current approach to stream typing is not adequately precise, defines a modeling approach for developing a new mapping, and sets specifications for the accuracy of the model. It also calls for development of a field protocol for inclusion in the forest practices board manual.

The Instream Scientific Advisory Group (ISAG) has developed a single program (the stream typing program) to develop and validate a GIS based model to predict the upstream extent of fish or fish habitat (Table 1).

Table 1. Stream typing rule group critical question and program.

Stream Typing Rule Group Critical Questions	Program Name	Task Type
How can the demarcation between fish-bearing and non-fish-bearing streams be accurately identified?	Stream Typing Program	Rule Tool

2.3 TYPE N RULE GROUP

Type N streams are non-fish-bearing streams that either do not provide suitable habitat to support fish or do not contain fish because of a natural barrier to fish migration. Type N streams are protected under FFR for several reasons. First, they provide habitat for stream-associated amphibians (SAA) covered by the agreement. Second, water quality standards pertaining to these streams need to be met. Finally, Type N streams contribute water, nutrients, woody debris, and sediment that affect downstream fish habitat and water quality.

The Type N riparian prescriptions are designed to accomplish the following FFR resource objectives:

1. Provide cool water by maintaining shade, groundwater temperature, flow, and other watershed processes controlling stream temperature),
2. Provide complex in- and near-stream habitat by recruiting large woody debris and litter,
3. Prevent the delivery of excessive sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams,

2.3.1 Rule Summary

There are two buffering strategies for Type Np streams, the clear-cut and the partial-cut strategies. The clear-cut strategy is prescribed for the westside, whereas landowners on the eastside have the flexibility to use either clear-cut or partial-cut strategies. The westside clear-cut strategy involves a patch buffering system where portions of the riparian stand can be clear-cut to the stream and other areas are protected with a 50-ft wide no-cut patch buffer. The patch buffer includes fixed and flexible components. Fixed components include 50-ft buffers around the sensitive sites (e.g., connected springs and seeps, Np initiation points; and stream junctions) and on both sides of the stream upstream 300-500 ft from the Type F/Type Np boundary. The flexible component allows the landowner to choose where to place the remaining buffer to bring the total buffer length to 50% of the Type-Np length. Eastside landowners have the option of using the 'partial-cut' strategy', a continuous 50 ft buffer along the length of the Type Np stream. The partial-cut buffer can be thinned, providing that the appropriate basal area and leave tree requirements are met. A 30 ft wide equipment limitation zone (ELZ) is established on all Type N streams (Np and Ni) to minimize sediment input from bank and soil disturbance. Operations within the ELZ are designed to avoid soil disturbance, and sediment delivery must be mitigated.

2.3.2 Strategy and Rationale

The Type N rules are based on the assumption that the riparian buffering strategies will result in aquatic conditions that meet the resource objectives and consequently achieve the three FFR performance goals. However, great uncertainty exists about these assumptions because the

functional relationships between riparian management practices, riparian functions and aquatic resource response are not well studied or understood. Several major areas of uncertainty include:

1. How to identify the upper boundary of perennial flow in Type N streams,
2. How riparian stands and the inputs and functions they provide respond to management practices and the level of protection provided by the prescriptions,
3. The habitat utilization patterns of SAAs and their response to riparian management practices, and
4. The effects of Type N riparian management practices on sediment, LWD, temperature and nutrient regimes in downstream fish-bearing streams.

The strategy for the Type N rule group is designed to address a set of critical questions related to the effectiveness of the rules in achieving FFR goals and resource objectives. The critical questions, programs, task types and responsible SAG are listed in Table 2.

Table 2. Critical questions and programs for the Riparian Strategy Type N rule group.

Type N Rule Group Critical Questions	Program Name	Task Type	SAG
How should the initiation point of Type Np streams be identified for management purposes?	Type N Delineation Program	Rule Tool	UPSAG
How do survival and growth rates of riparian leave trees change following Type Np buffer treatments? Are riparian processes and functions provided by Type Np buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall? How do other buffers compare with the FFR Type N prescriptions in meeting resource objectives? Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives?	Type N Buffer Characteristics, Integrity and Function	Effective-ness	RSAG
Is Stream Associated Amphibian (SAAs) population viability maintained by the Type N prescriptions?	Type N Amphibian Response	Effective-ness	LWAG
Can the methods used to identify and characterize sensitive sites be improved?	Sensitive Site Program	Rule Tool	LWAG
Is the Type N riparian strategy effective in maintaining downstream fish habitat and harvestable fish populations?	Downstream Water Quality/Fish Response	Intensive	
What is the current status of riparian conditions and functions in Type N streams on a statewide scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type N)	Extensive	RSAG

2.4 TYPE F RULE GROUP

The Forest and Fish Report (FFR) recognizes differences in riparian systems and processes between eastern and western Washington. It describes the goal of the riparian strategies for westside Type F (fish-bearing) streams as follows:

> "…Riparian silvicultural treatments and conservation measures that are designed to result in riparian conditions on growth and yield trajectories towards what are called 'desired future conditions.' As used in this report, desired future conditions are the stand conditions of a mature riparian forest, agreed to be 140 years of age (the midpoint between 80 and 200 years) and the attainment of resource objectives. …These desired future conditions are a reference point on the pathway to restoration of riparian functions, not an endpoint of riparian stand development."

The eastern Washington riparian rules for Type F streams provide for stand conditions that vary over time within a range that emulates historic disturbance regimes, provides riparian functions needed to meet performance goals, and maintains forest health. Specified riparian functions include bank stability, wood recruitment, leaf litter fall, nutrients, sediment filtering, and shade. More specifically, the eastside rules were intended to create a range of stand characteristics within the riparian management areas that

1. Fall within the range of historical variability,
2. Minimize risk of catastrophic events, and
3. Provide the functions that support the production of harvestable populations of salmonids.

It is assumed that riparian forests managed in accord with these strategies will provide adequate levels of key riparian functions to meet the overall performance goals for harvestable levels of salmonids, long term viability of amphibian populations, and the protection of water quality while maintaining a viable timber industry. The key functions include sediment, large wood, shade, and nutrients. These functions are the focus of the resource objectives and performance targets established for this rule group.

2.4.1 Rule Summary

The western Washington Type-F riparian rules prescribe riparian buffers (riparian management zones or RMZs) equal in width to a site-potential tree height and are divided into three zones; core, inner, and outer. The core zone, closest to the stream, is 50 feet wide and generally is a no-harvest zone. The inner zone extends from 10 to 100 feet outside the core zone, depending on the site class and stream size. Several management strategies are allowed in the inner zone with the intent that the combined core and inner zone will be placed on a trajectory to grow into the desired future condition (DFC). The outer zone extends beyond the inner zone to the edge of the RMZ. The outer zone is managed to provide a variety of protections for special sites and wildlife habitat, while still contributing to the overall riparian functions provided by the RMZ. A variety of measures in the westside Type-F riparian rules address site-specific situations, operational concerns of landowners, conversion of hardwood-dominated sites to conifer, placement of large wood, catastrophic loss from fire or wind, and alternate plans.

The eastern Washington Type-F riparian rules require riparian buffers designed to provide the specified functions and meet the intent of the rule. Riparian management areas are divided into three zones, a core zone, an inner zone, and an outer zone. The core is a 30-foot wide no harvest zone that is intended to protect bank stability and maintain the majority of shade and wood recruitment. The inner zone is 45 to 70 feet wide and the outer zone is between 0 to 55 feet

wide. The sum of the core zone, inner zone and outer zone approximates the length of a site-potential tree, which varies with site class. Allowable harvest within the inner and outer zones is different for each of three elevation bands, referred to as habitat types in the rules. These elevation bands were intended to emulate variations in natural disturbance regimes, variations in species distributions, and other riparian characteristics. Two temperature rules overlay the eastside rule package. The first defines the amount of shade needed to meet state water-quality standards. The second (the bull trout overlay) is intended to provide the additional temperature protection required by bull trout (see Bull Trout Rule Group, below).

2.4.2 Strategy and Rationale

The western Washington Type F riparian rules are based upon the assumptions listed below:
1. The DFC basal area targets adequately describe mature riparian forest conditions.
2. The growth model used for DFC adequately projects riparian growth and mortality.
3. Some hardwood-dominated riparian stands need to be converted to conifer in order to achieve DFC.
4. Stands that meet the DFC target will provide the aquatic habitat conditions needed to provide the functions to meet the overall performance goals and resource objectives.

The eastern Washington Type F riparian rules are based upon the following assumptions:
1. The management strategies in the Type-F rules will put stands in the RMZ on a trajectory that is within the range of natural variability.
2. The defined elevation bands are reasonably accurate reflections of the spatial distribution of historical disturbance regimes and species compositions
3. The management strategies will minimize risk of catastrophic events within the RMZs.
4. The management strategies will put stands on a trajectory that will provide the riparian functions needed to support harvestable populations of fish.
5. The temperature overlays are necessary to provide stream temperatures that meet the state water quality standards and the needs of bull trout.

Uncertainties about the validity of the assumptions and the effectiveness of the rule lead to a series of critical questions and programs to address them (Table 3). They include: 1) the Type F Statewide Effectiveness Monitoring Program, which will address effectiveness of the Type F riparian rules in meeting performance targets and achieving resource objectives; 2) the hardwood conversion project, which will address uncertainty regarding strategies and prescriptions for managing hardwood dominated stands; 3) the Extensive Riparian Trend Monitoring, which will document status and trends of riparian conditions on Type F streams on a regional scale; and, 4) the DFC model validation, a rule tool program that addresses uncertainties regarding the validity of the westside DFC performance targets and the accuracy of DFC model that is used to project stand trajectory to age 140. Two programs will address issues specific to the eastern Washington Type F prescriptions. The Eastside Desired Future Range and Target Development Program will validate the eastside Type F prescriptions and develop eastside LWD performance targets. The Eastside Temperature Nomograph Program will validate the shade-temperature relationships for eastern Washington in the forest practices rules. One related program, the Bull Trout overlay temperature program, will address effectiveness of the eastside Type F shade requirements. This program is discussed in the Bull Trout rule group, below. Finally, the aquatic habitat-biotic response program addresses uncertainty concerning the response of aquatic organisms (e.g., fish

populations) and their habitat to changes in riparian conditions and inputs. Design and implementation of this study is currently on hold pending further development of the intensive monitoring program.

Table 3: Critical questions and programs for the Riparian Strategy Type F rule group.

Type F Rule Group Critical Questions	Program Name	Task Type	Sag
Does the DFC model, including basal area targets, adequately describe mature riparian forests?	DFC Validation Program	Rule Tool	RSAG
Are the Type F riparian rules effective in meeting the performance targets, resource objectives, and overall performance goals of FFR?	Type F Statewide Effectiveness Monitoring Program	Effective-ness	RSAG
Where and how should hardwood conversion projects be conducted, and what are the ecological outcomes?	Hardwood Conversion Program	Effective-ness	RSAG
What is the desired range of conditions for eastside riparian stands and what are appropriate LWD performance targets?	Eastside Desired Future Range & Target Development Program	Rule Tool	SAGE
Can the shade/temperature relationships in the eastside temperature nomograph be refined?	Eastside Temperature Program	Rule Tool	SAGE
What is the current status of riparian conditions and functions in Type F streams on a regional scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type F)	Extensive	RSAG
How do aquatic organisms respond to changes in habitat and water quality associated with changes in riparian inputs and functions?	Aquatic Habitat Biotic Response	Intensive	RSAG

2.5 BULL TROUT RULE GROUP

Bull Trout are listed under ESA as threatened throughout their range in Washington. A factor contributing to their "threatened" status is the degradation of habitat, especially increasing stream temperatures. Bull Trout temperature requirements are cooler than those of other salmonid species. The bull trout habitat overlay was developed to protect potentially suitable habitat for all life history stages of bull trout.

2.5.1 Rule Summary

Riparian timber harvest prescriptions in eastern Washington differ for streams located within or outside the bull trout habitat overlay area. When a timber harvest unit is located within the overlay, "all available shade" must be retained within 75 feet of the bankfull width or channel migration zone, whichever is greater. When outside the overlay, prescriptions fall under the standard shade rule, which can allow for harvest of a portion of shade trees within the 75 feet, depending on elevation and canopy cover existing prior to harvest. The standard shade rule, which targets earlier water quality temperature standards, is believed to be inadequate to meet the optimal bull trout water temperatures.

2.5.2 Strategy and Rationale

Problems arise during implementation of the bull trout overlay. Because knowledge of the current and potential distribution of the species is imprecise, large areas of forestland in eastern Washington are currently enveloped by the bull trout overlay. Some areas on the overlay may be have never been occupied by bull trout and may not have the potential to support bull trout in the future, thus placing forestlands under inappropriate restrictions, resulting in riparian conditions that may not meet the intent of the eastside riparian strategy. Conversely, if neither the bull trout overlay nor the standard riparian prescriptions provide adequate stream temperature protection, other Forest and Fish goals will not be met.

The Bull Trout "All Available Shade" Rule is based on the following assumptions:

- Shade and water temperature are more at risk in eastern Washington than in western Washington because of the potential for more shade removal within the prescriptions and warmer air temperatures.
- The water temperature criteria within the current (prior to 2003) water quality standards (and nomographs) are too warm to meet the optimal cold water temperature needs of bull trout.
- A primary factor contributing to bull trout decline is habitat degradation, especially as it relates to stream temperature. Past forest practices, including shade removal, have been a contributing factor. Therefore with restoration of habitat and consequent reduction in stream temperatures, bull trout should rebound in those habitats.
- Historically when habitats were more optimal, watersheds were more extensively occupied by bull trout, including all life history strategies such as resident and migratory (i.e. fluvial and adfluvial).
- The bull trout habitat overlay includes areas that never have nor ever will have the potential to support bull trout. Where this occurs, forestlands may be placed under inappropriate harvest restrictions.
- The "all available shade" rule should provide more shade and water temperature protection than the standard eastside prescriptions.
- The densiometer methodology can adequately measure and determine "all available shade".
- All shade affecting stream temperature comes from within 75 feet of the stream.

The following list of uncertainties apply to the bull trout rule"

1. Lack of agreement on bull trout temperature requirements.
2. Different perspectives exist regarding the accuracy of the bull trout habitat overlay in identifying habitat potentially suitable for bull trout.
3. The characteristics of "unsuitable" bull trout habitat are poorly defined.
4. The effectiveness of the densiometer methodology for determining effective shade, especially "all available shade" is not fully accepted.
5. The meaning of "all available shade" is unclear.

The strategy for the bull trout rule group is intended to answer a set of critical questions that address these uncertainties (Table 4).

Table 4: Critical questions and programs for the Bull Trout rule group. All programs are administered by BTSAG.

Bull Trout Rule Group Critical Questions	Program Name	Task Type
Are both the standard eastside prescriptions and the "all available shade "rules effective in protecting shade and stream temperature and in meeting the water quality standards? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature? Are FFR riparian prescriptions effective at protecting groundwater flow and temperature?	BTO Temperature Program	Effective-ness
How can habitat suitable for bull trout be identified?	Bull Trout Habitat Identification Program	Rule Tool

Two programs are proposed to address these questions. The Bull Trout Overlay Temperature Program is designed to address the effectiveness of FFR rules on shade and stream temperatures in bull trout habitat, as well as other eastside fish habitat. The Bull Trout Habitat Identification Program is identifying bull trout habitat for management purposes.

2.6 CHANNEL MIGRATION ZONE RULE GROUP

The channel migration zone (CMZ) is an area within a river or stream valley where the active channel is prone to move. Channel movement in the CMZ can disturb adjacent vegetation in buffer zones causing changes in riparian function and associated habitat.

2.6.1 Rule Summary

The intent of the CMZ rule is to maintain riparian forest functions along migrating channels (e.g., woody debris recruitment, bank reinforcement, shade, and litter). No timber harvest, salvage, or road construction (except for road crossings) is allowed within CMZs without an alternate plan that specifies the conditions which will provide equivalent protection of public resources as described in the rules.

2.6.2 Strategy and Rationale

The strategy for the CMZ rule group is intended to answer a set of critical questions that address uncertainties concerning CMZ delineation and effectiveness (Table 5). The overall strategy is to address the delineation of CMZs while cooperating with the riparian rule group to develop and implement a long-term riparian/CMZ effectiveness-monitoring program.

Question 1 arises from the need to identify and delineate the CMZ so that the prescriptions can be implemented. The rule assumes that the CMZ can be identified and the extent of the channel migration zone can be and will be consistently delineated by landowners. This assumption has

high uncertainty because CMZs are relatively easy to recognize but exact boundaries are difficult to define in the field and from aerial photographs. Incorrect delineation of the CMZ edge results in incorrect placement of the adjacent RMZ, making it vulnerable to channel disturbance. Question 2 addresses whether areas prone to channel migration are predictable, which is based on the assumption that the area subject to channel migration during the last 100 years is the same that will be subject to channel migration during the next 100 years. There is a high level of uncertainty with this assumption because changes in land-use and other factors during the next 100 years could increase the risk of more frequent channel avulsion (the most common form of channel migration in forested conditions) leading to increased rates of migration.

Question 3 addresses the success of the CMZ rule in maintaining RMZ integrity and riparian functions. The rule assumes that riparian functions can be maintained by protecting forests in the CMZ and RMZ to provide riparian functions despite the effects of rapidly migrating channels. However, it is not clear that alternative plans will be equally successful because of a lack of information and experience on the part of landowners and regulators. Moreover, with changing forest practices it is uncertain that past migration patterns predict future migration and fluvial disturbance of the RMZ is likely. A moderate uncertainty is assigned to alternative plans and a high uncertainty is assigned to the protection of RMZ by CMZ because of the potential for increased migration in the future as described in question 2. The CMZ rule group is divided into three programs addressing the critical questions.

Table 5. Critical questions and programs for the CMZ Rule Group. All effectiveness tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Channel Migration Zone Rule Group Critical Questions	Program Name	Task Type
What field/map criteria allow consistent, repeatable delineation of the CMZ lateral boundaries (“edge”)?	CMZ Delineation Program	Rule Tool
Will the physical conditions that drive channel migration change with the application of FFR rules?	CMZ Validation Program	Effective-ness
Does the CMZ rule meet FFR performance goals and resource objectives?	CMZ Effectiveness Monitoring Program	Effective-ness

2.7 UNSTABLE SLOPES RULE GROUP

The FFR goal for unstable-slopes management is to prevent forest practices from increasing mass wasting (landslides) beyond the naturally occurring rate of slope failure. The intent of the rule is to protect water quality and aquatic habitat by minimizing sediment delivery from mass wasting.

2.7.1 Rule Summary

The rule strategy begins with identification of unstable slopes. Once an unstable slope is identified, the strategy is either to avoid the area or conduct a risk evaluation through the SEPA process. The default protective measure for unstable slopes is avoidance. The rule strategy relies on the ability of forest managers to recognize and mitigate for unstable slopes within a forest practice application (FPA) and approval process. If forest practices are planned on potentially unstable slopes, the application process requires SEPA review. The rule strategy

depends on the correct identification and assessment of unstable slopes, which is achieved by defining unstable landforms at a statewide level in the rules and defining regional unstable landforms using local knowledge. A specific FFR rule relates to harvest on the groundwater recharge areas of deep-seated landslides in glacial sediments.

2.7.2 Strategy and Rationale

Table 6 presents a set of critical questions for the unstable slopes rule group and identifies a series of programs to address them. The strategy is to implement an unstable-landform identification program, to address critical questions 1 and 2, along with mass wasting effectiveness monitoring, extensive monitoring, and validation programs to assess the effectiveness of landform recognition and mitigation at various scales.

Table 6. Critical questions and programs for the Unstable Slopes Rule Group. All effectiveness, extensive, and intensive tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Unstable Slopes Rule Group Critical Questions	Program Name	Task Type
What screening tools can be developed to assist in the identification of potentially unstable landforms that minimize the omission of potentially unstable landforms?	Unstable Landform Identification Program	Rule Tool
Are deep-seated landslides in glacial sediments along with their recharge area being correctly and uniformly identified, and does harvesting of the recharge area promote their instability?	Glacial Deep-Seated Landslides Program	Rule Tool
Are unstable landforms being correctly and uniformly identified and evaluated for potential hazard?	Mass Wasting Prescription Effectiveness Monitoring Program	Effective-ness
Are the mass wasting prescriptions and mitigation measures effective in preventing landslides from roads and harvest units?		
What is the natural (background) rate of landsliding on managed forest lands?	Mass Wasting Landscape Scale Monitoring Program	Extensive
Are the FFR unstable-landform rules reducing the rate of management-induced landsliding statewide?		
What levels of cumulative sediment inputs are harmful to the resource at the basin scale?	Mass Wasting Validation Program	Intensive

2.8 ROADS RULE GROUP

The intent of the roads rule group is the protection of water quality and riparian/aquatic habitat by minimizing sediment delivery and changes in hydrology due to roads. Fish passage at road crossing structures is treated as a separate rule group.

2.8.1 Rule Summary

The rules protect water quality and riparian/aquatic habitats through prescriptions and road Best Management Practices (BMPs). Implementation of prescriptions and BMPs during the road maintenance and abandonment process (RMAP) should minimize road runoff and the connection between roads and streams. The road rules specify prescriptions for road construction, maintenance and abandonment, landings, and stream-crossing structures. In addition, the Board

Manual identifies BMPs for roads and landings. Beyond the site-specific limitations and BMPs, the rules require RMAPs for all forest roads to be developed within 5 years, with implementation to be complete within 15 years.

2.8.2 Strategy and Rationale

The basic assumptions of the roads rule group are

1. Implementation of road prescriptions will result in achieving FFR performance goals and resource objectives, including:
   a. meeting water quality standards,
   b. providing clean water and substrate and maintain channel forming processes by minimizing the delivery of management-induced coarse and fine sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams,
   c. Maintaining surface and groundwater hydrologic regimes (magnitude, frequency, timing, and routing of stream flow). This by disconnecting road drainage from the stream network, preventing increases in peak flows causing scour, and maintaining the hydrologic continuity of wetlands."
2. Assessment and planning using RMAPs is the best method to assure effective implementation of BMPs and this will achieve the above objectives
3. Roads differ in their degree and importance of impact to the resources of concern, and we can identify and prioritize roadwork based on these differences.
4. Appropriately identified standard BMPs are effective at achieving functional objectives.

Assessment of the rules leads to three sets of critical questions that direct the monitoring and research programs. Each question-set consists of a general main question that defines the program and several sub-questions that identify the research projects within the program. The three main questions are expressed in Table 7 along with the programs to address them.

The monitoring strategy is to begin basin-scale effectiveness monitoring as soon as possible by quickly developing the Road Surface Erosion model, which is an essential effectiveness monitoring tool. The effectiveness monitoring program includes both a site-scale component and a basin-scale component. Validation monitoring, which is more complex and time-consuming, will come later. This approach will quickly inform the uncertainties about BMP implementation and their ability to meet FFR targets. If BMP implementation is ineffective, validation monitoring is unwarranted. This approach is warranted by our long experience with road sediment problems and BMPs. The strategy for each program is described in the next chapter.

Table 7: Critical questions and programs for the Unstable Slopes Rule Group. All effectiveness, extensive, and intensive tasks are administered by UPSAG.

Roads Rule Group Critical Questions	Program Name	Task Type
Are road prescriptions effective at meeting site-scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions, which are covered in the Mass Wasting Rule Group section).	Road Effectiveness Monitoring Program	Effective-ness
Have the correct performance targets for sediment delivery and connectivity been identified?		
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions which are covered under the Mass Wasting Rule Group).	Extensive Roads Monitoring Program	Extensive
What levels of cumulative sediment inputs are harmful to the resource at the basin scale? (Validation of road sediment targets).	Roads Validation Program and Cumulative Sediment Effects.	Intensive

2.9 FISH PASSAGE RULE GROUP

The intent (objective) of the fish passage rule is to install, upgrade and/or maintain stream crossings by 2016 that provide fish passage at all life stages.

2.9.1 Rule Summary

Fish passage blockages at road crossing structures are to be addressed as part of the road maintenance and abandonment plan (RMAP) process. Road crossing structures will be inventoried, evaluated and prioritized during the RMAP planning process. Those that do not provide fish passage will be repaired or replaced within 15 years, typically on a "worst-first" basis. WDFW's hydraulic code rules, the associated barrier-assessment manual, and DNR's forest practices rules apply to crossing structures on forest roads.

2.9.2 Strategy and Rationale

Critical questions were developed through an analysis of the FFR rules during which the assumptions and uncertainties underlying the rule were identified. From these uncertainties, the critical questions were derived. Research and/or monitoring programs are designed to reduce the uncertainty and address the critical questions. The fish passage rule is based on the following assumptions:

1. Achieving the objective is critical for recovery of depressed stocks and the health of all fish at all life stages.
2. Implementation of the rules will result in achieving the objective to maintain or provide passage for fish in all life stages and to provide for the passage of woody debris likely to be encountered.
3. Assessment, prioritization, and implementation of RMAPs will achieve the objectives in a timely manner.

4. Current stream crossing replacement standards are adequate to address all fish and life history stages.
5. Hydraulic code criteria are effective at achieving resource objectives.
6. Fish species and life history stage distributions can be characterized statewide.
7. Performance targets have not been developed for all fish/life history stages.
8. Assessment of hydraulic swimming capabilities of lesser-understood species/life stages is achievable within 15 years.
9. Assessment of movement patterns of lesser-understood species/life stages in highly variable stream systems is achievable within 15 years.
10. Stream simulation methods provide passage for all fish and life history stages.

These assumptions and uncertainties guided development of a set of critical questions for the fish passage rule group and a monitoring program to address them (Table 8).

Table 8. Critical questions and programs for the Fish Passage Rule Group. All effectiveness and extensive tasks are administered by ISAG.

Fish Passage Rule Group Critical Questions	Program Name	Task Type
Does the RMAP process correctly identify the stream crossing structures that impede fish passage? Are the corrective measures effective in restoring fish passage?	Fish Passage Effectiveness Monitoring Program	Effective-ness
What is the current status of fish passage on a regional scale, and how are conditions changing over time?	Extensive Fish Passage Monitoring Program	Extensive

2.10 PESTICIDES RULE GROUP

The objectives of the pesticides rule group is to manage pesticide use to achieve water quality standards, meet label requirements, and avoid harm to riparian vegetation. In the context of the forest practices rules pesticide means "any insecticide, herbicide, fungicide or rodenticide, but does not include nontoxic repellents or other forest chemicals."

2.10.1 Rule Summary

The pesticide rules include a series of regulations that cover: 1) aerial application of pesticides, 2) ground application of pesticides with power equipment, and 3) hand application of pesticides. The rules for aerial application of pesticides prescribe a setback (offset) to prevent application of pesticides within the core and inner zones of Type F and S streams, or the wetland management zone (WMZ) of Type A or B wetlands. In these cases the offset is from the outer edge of the inner zone or the WMZ. Offsets are also prescribed for flowing Type N streams and Type B wetlands < 5 acres, however in these cases the offsets are measured from the edge of the bankfull channel or wetland. The offset distances vary depending on water type, the type of nozzle used, and wind conditions at the time of application. Separate guidelines govern ground application of pesticides with power equipment and hand equipment within RMZs and WMZs.

2.10.2 Strategy and Rationale

The main assumption is that the pesticide rules will be effective in achieving the objectives of meeting water quality standards, label requirements and preventing damage to vegetation in RMZs and WMZs. There is some level of uncertainty about this, particularly in the case of aerial application due to potential difficulties due to terrain and wind conditions. A single critical question has been developed, with a corresponding effectiveness program (Table 9).

Table 9. Critical questions and programs for the Pesticides Rule Group.

Pesticides Rule Group Critical Questions	Program Name	Task Type
Do the pesticide rules protect water quality and vegetation within the core and inner zones of Type S and F RMZs or the WMZs of Type A or B wetlands?	Forest Chemicals Program	Effective-ness

2.11 WETLAND PROTECTION RULE GROUP

Wetland adaptive management goals are identified in the FFR report as: "The goal … is to clarify the mapping of wetlands and provide for an assessment of the functions of associated wetlands. This is intended to include an assessment of the functions served by forested wetlands and the potential impacts of harvest activities in forested wetlands. The assessment may include the determination of harvest activities that cannot be adequately mitigated or recovered. Where such assessments suggest that changes in forest practices are required, this Appendix is intended to provide the mechanism for the consideration of additional rules for the protection of such wetlands."

The intent of the wetland rules is to achieve no net loss of wetland function (water quality, water quantity, fish and wildlife habitat, and timber production) by avoiding, minimizing, or preventing sediment delivery and hydrologic disruption from roads, timber harvest, and timber yarding. The main strategy is to use forest and fish rules and watershed analyses as the primary vehicle for implementing wetland BMPs.

2.11.1 Rule Summary

The forest practices rules classify wetlands into two categories. Type A wetlands include non-forested wetlands greater than 0.5 acres in size or forested wetlands and non-forested bogs greater than 0.25 acres. Type B wetlands included non-forest wetlands greater than 0.25 acres in size. Landowners are required to inventory and map wetlands as part of the FPA for timber harvest or road construction. Wetland management zones (WMZ) are prescribed for all Type A wetlands and Type B wetlands greater than 0.5 acres. The WMZs have variable widths based on the wetland type and size. The specific leave tree requirements within WMZs differ for eastern and western Washington. There are also restrictions on the use of ground based harvesting equipment within WMZs. Within forested wetlands, harvest methods are limited to low impact harvest or cable systems and landowners are encouraged to leave a portion of the wildlife reserve tree requirement within the wetland. Additional rules apply to road construction to assure that there is no net loss of wetland function. The preferred option in the guidance is to prevent

impacts by selecting road locations outside of wetlands, however where that is not possible, the guidelines seek to minimize and mitigate impacts.

2.11.2 Strategy and Rationale

The wetland rules are based on the following assumptions:
1. Implementation of the wetland prescriptions will result in achieving no net loss of wetland functions over a timber rotation, assuming that some wetland functions may be reduced until the mid-point of a timber rotation cycle.
2. Assessment and planning in watershed analysis and implementation of forest practices rules will achieve the stated resource objectives.
3. Appropriately identified, standard BMPs are effective at achieving the resource objectives.
4. Forested wetlands will successfully regenerate following timber harvest.

There is uncertainty whether these assumptions are valid. Furthermore, the wetland functions listed in the rules are limited and significant uncertainty exists regarding their adequacy to meet the resource objectives of the FFR report. The degree to which current rules for wetland mitigation will achieve the "no net loss of wetland function" policy is unclear. No objective performance measures are available for determining the:
1. Range of wetland functions affected by road construction or
2. Net loss or gain of these functions over time.

These assumptions and uncertainties guided development of critical questions and research and monitoring programs to address them (Table 10).

Table 10. Critical questions and programs for the Wetlands Rule Group. All effectiveness tasks are administered by WETSAG; rule tools are administered by DNR in collaboration with WETSAG.

Wetlands Rule Group Critical Questions	Program Name	Task Type
Are forested wetlands regenerating sufficiently to maintain wetland functions?	Wetlands Revegetation Effectiveness Program	Effective-ness
Are road construction activities in wetlands adequately mitigated to achieve no net-loss of wetland functions?	Wetland Mitigation Program	Effective-ness
Are current WMZs effective in providing adequate levels of LWD? Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids? Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect stream temperatures in connected streams? Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	WMZ Effectiveness Monitoring Program	Effective-ness
How should wetlands be classified and mapped for management purposes?	Wetland Tools Program	Rule Tool

The rule strategy for wetlands is to establish through a comprehensive literature review the current scientific basis for evaluating wetland functional relationships with salmonids, covered species and water quality and quantity. The literature review will be followed by development of tools that show wetland locations (GIS Layer) and functions (Hydro-geomorphic HGM classification system). Specific effectiveness/validation studies will be developed to answer specific questions about the effects of rule implementation at the landscape and site scales.

2.12 WILDLIFE RULE GROUP

Although the FFR agreement is focused on water quality, fish, and stream associated amphibians, CMER has funded a number of other wildlife research projects since the late 1980s. These projects have addressed both general, multi-species, state-wide issues, as well as species specific concerns about the effects of forest practices. Both the Policy Committee and CMER have acknowledged that wildlife issues are important and need attention and are currently funding additional sampling and analyses of a study that examines wildlife use of 2 streamside buffer designs. However, the focus of CMER is currently on FFR priorities and the only CMER funding for other wildlife would be from the State general funds.

2.12.1 Rule Summary

Forest practice rules directed at wildlife conservation have taken 2 approaches: 1) general state-wide requirements, and 2) species specific strategies. In addition, several other rules may benefit wildlife through the retention or enhancement of habitat, such as riparian buffers, upland management areas, landslide hazard zonation, etc.

The only general state-wide rule specifically directed at wildlife conservation is the provisions for wildlife reserve tree management (WAC 222-30-020[11]). Specifications for the retention of wildlife reserve trees, green recruitment trees, and down logs are provided for both eastern and western Washington.

Species specific forest practice rules are closely tied to both state and federal endangered and threatened species programs. Under forest practices, the habitat of listed species is defined as critical habitat (state) and any proposed activity in critical habitat becomes a Class-IV Special forest practice under SEPA (WAC 222-10-040), requiring consultation, evaluation, an environmental impact statement, and mitigation. There are currently 10 species for which these rules apply, e.g., the bald eagle (*Haliaeetus leucocephalus*), grizzly bear (*Ursos arctos*), northern spotted owl (*Strix occidentalis*), and marbled murrelet (*Brachyramphus marmoratus*).

Another species specific approach that avoids the need for direct rule making that has been endorsed by the Forest Practices Board is the development and adoption of management plans or the specification of "voluntary" guidelines. The federal listing of the lynx (*Lynx canadensis*) prompted the state and a few large private landowners in northeastern Washington to develop and adopt a lynx management plan. The state listing of the western gray squirrel (*Sciurus griseus*) resulted in landowners agreeing to apply forest practice guidelines developed by the Washington Department of Fish and Wildlife in areas known to contain the species.

These rules and associated guidelines can become very complex. Each species generates specific definitions of habitats, specific monitoring methods, and specific provisions for protection of sites that vary with the species needs. In addition, the Forest Practices Board often adopts rule options that allow landowners to develop species specific management plans.

2.12.2 Strategy and Rationale

The Landscape and Wildlife Advisory Group (LWAG) has been developing an overall wildlife workplan for several years. However, focused plan development for wildlife issues other than those associated with FFR were delayed until the FFR workplan is completed. Nonetheless, LWAG continues to work on the broader workplan as issues and time allows.

To date, LWAG has identified a number of subprograms that contain several issues, each with critical questions (Table 11).

Table 11. Wildlife issues (in order of priority) and critical questions that are addressed by LWAG in different forums.

Wildlife Rule Group Critical Questions	Program Name	Task type
What are the values of snags retained in upland management units and RMZs? Is there a threshold response by wildlife to snag density? What are the fates of wildlife reserve trees (WRT) and green recruitment trees (GRT) in managed forests? What are the most-effective ways of retaining and replacing snags?	Effectiveness of snags for wildlife	Effectiveness, Validation
What are the effects of variation in stand establishment practices, herbicides, thinning, fertilization, and rotation lengths on vegetation and wildlife? Does the concept of the steady-state shifting mosaic apply and how does that process effect wildlife?	Conifer management effects on wildlife	Validation Effectiveness
What role do RMZs, UMAs, and other forest patches play in maintaining species and providing structural and vegetative characteristics thought to be important to wildlife? What are the functions of large legacy trees (snags, down wood, high stumps) as compared to the smaller complements produced in intensively managed forests? What are the roles and fates of special sites (e.g., rock outcrops, cliffs, talus slopes, isolated small wetlands, etc.) in managed forests?	Legacy features and their effect on wildlife	Effectiveness, Validation
What are the movement patterns, processes, and distances of amphibians in managed forests? Do amphibians persist in refugia following timber harvest or is subsequent occupancy related to movements from other areas? How quickly do amphibians re-colonize areas, particularly habitat	Amphibian movement and distribution effectiveness	Effectiveness

outside the stream network? What is the role of ponds created by beaver, slumps, rotational failures, road ditches, and sediment traps, and off-channel habitats in the distribution and abundance of still-water breeding amphibians?	monitoring	
What is the status and trends of bats in managed forests?	Status and trend of forest bats	Extensive
What is the role of WRTs and GRTs in bat ecology? What are the relationships between forest management and bat foraging and roosting?	Forest bat effectiveness	Effectiveness
What is the relationship between the abundance and productivity of wildlife and gradients in the composition and structure of ponderosa pine stands?	Ponderosa Pine habitat effectiveness study	Effectiveness
What are the effects of forest practices on the western gray squirrel and oviposition sites of egg-laying reptiles? What is the role of isolated oak trees and small patches of oaks? What are the appropriate management approaches to maintaining and restoring oak woodlands at stand and landscape levels?	Oak woodland habitat effectiveness study	Effectiveness

LWAG is currently developing specific projects for each issue based on the critical questions listed above.

3.0 PROGRAM DESCRIPTIONS

This section describes the purpose and research strategy for each program by task category. The program description is intended to include the identification of specific projects that will be implemented to address critical questions. Pending research priorities (see Section 4), projects may or may not be defined at this time. Eventually, over time, all projects and the rationale for conducting the projects will be included in the program descriptions.

3.1 EFFECTIVENESS MONITORING PROGRAMS

3.1.1 Type N Buffer Characteristics, Integrity and Function Program

Purpose

The purpose of this program is to evaluate the effectiveness of Type N riparian prescriptions, including mortality of buffer trees, stand characteristics and trajectory over time, changes in functions in response to the prescriptions, and effectiveness in achieving performance targets and meeting water quality standards.

Type N prescriptions are highly uncertain because they are based on many assumptions that have not been adequately studied or validated. This program addresses the major Type-N assumptions / uncertainties by focusing on four critical questions.

1. How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?
2. Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?
3. What riparian protections measures are needed to meet resource objectives and performance standards?
4. Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?

Strategy

A four-project strategy is underway to address the program questions (Table 12). The Type-N FFR buffer integrity, characteristics, and function project will evaluate the effectiveness of the FFR Type-N riparian prescriptions, including survival of buffer leave trees, stand condition and trajectory over time, and changes in riparian functions including shade, LWD recruitment, and streambank protection. This will be accomplished by randomly sampling Type N forest practices and pairing the "treatment" sites with un-harvested control sites. This approach will provide an unbiased estimate of variability for the performance of the buffers relative to the Type N performance targets. The design for this project has been approved and funded by CMER, and scheduled to begin in the summer of 2003 in two forest zone strata, one on the eastside and one on the westside. The second project, the Type N Experimental Buffer Treatment Project, is a cooperative project with DNR and USFS that compares the response of riparian stands, temperature, litter fall, nutrients and downed wood to a range of buffer treatments applied in sets of small paired watersheds. This design provides the high level of control needed to distinguish differences in response to variations in buffer treatments. This information, in combination with

the results from the buffer integrity, characteristics, and function study, is essential for understanding how effective the different elements of the FFR prescriptions are for resource protection. Baseline data collection is underway, with harvests scheduled to begin in the fall of 2003. CMER plans to collaborate with the DNR and USFS to assist in their study and develop a revised study plan that addresses FFR concerns and will expand the study to other regions. The third "project" Type N Performance Target Validation Project, has not been scoped at this time, but will probably consist of one or more studies designed to validate the relationships between Type N performance targets and aquatic resource response. This comparison will ensure that the performance targets provide a meaningful indication that FFR resource objectives are being achieved. Finally, the Type N Classification Project will explore potential methods of classifying Type N streams to provide a context for interpreting channel response to management practices. The need for the latter project will depend on the results of the above projects and potentially on the findings of the N Amphibian Response programs (see below).

Table 12. Type N Buffer Characteristics, Integrity and Function Program.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?	Type N FFR Buffer Integrity, Characteristics and Function Project
Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?	Type N Buffer Integrity, Characteristics and Function Project Type N Experimental Buffer Treatments Project
How do different buffering strategies compare with the FFR Type N prescriptions in meeting resource objectives?	Type N Experimental Buffer Treatments Project
Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?	Type N Performance Target Validation Project
Can a classification system based on process or function explain variability in the response of Type N channels to forest practices?	Type N Classification Project

3.1.2 Type N Amphibian Response Program

Purpose

The purpose of this program is to addresses critical questions concerning the response of stream-associated amphibians (SAAs) to forest practices, particularly the Type N riparian prescriptions. Many uncertainties exist regarding the distribution of SAAs, their life history and habitat utilization patterns, population dynamics, effects of forest practices on SAA habitats, and the response of SAA populations to these changes. Consequently, the Type N riparian rule is based on many assumptions, particularly that buffering portions of perennial Type N streams, i.e. a set of 'sensitive' sites thought to provide high quality SAA habitat, will be adequate to maintain the viability of SAA populations. These assumptions and uncertainties have been examined and used to develop a series of sub-questions under the main critical question (Table 13).

Table 13. Type N Amphibian Response Program.

Critical Questions	Project
Is SAA population viability maintained by the Type N prescriptions? Do SAAs continue to occupy and reproduce in the patch buffers? Do SAAs continue to occupy and reproduce in the ELZ only reaches? If SAAs do not continue to occupy the ELZ only reaches, do they re-occupy those reaches before the next harvest? How does SAA habitat respond to the sensitive site buffers? How does SAA habitat respond to variation in inputs, e.g. sediment, litter fall, wood? How do SAA populations respond to the Type N prescriptions over time?	Detection/Relative Abundance Methodology SAA Population Viability Response to Type N Prescriptions.

Strategy

Two projects are proposed to implement this program. The Detection/Relative Abundance Methodology Project is currently underway. It is designed to evaluate and develop a standard methodology for sampling SAAs in headwater forest streams. It addresses the need for a research/monitoring methodology to detect amphibians and determine their relative abundance. The most widely used methods produce high variance estimates and detection probabilities are unknown. The project should be completed before future SAA research projects are initiated.

The SAA Population Viability Response Project will address an important validation/effectiveness issue, i.e. the viability of amphibian populations as the Type N prescriptions are applied across the landscape and over time. This project is currently under development and integration with the Type N/F effectiveness program is being explored.

3.1.3 Type F Statewide Prescription Monitoring Program

Purpose

The purpose of this study is to evaluate the effectiveness of the FFR Type-F riparian buffers and prescriptions. This purpose will be achieved by evaluating the magnitude and duration of changes in shade/stream temperature, LWD input/function, litter fall and sediment input. Although the new Type F prescriptions require wider buffers including a 50 ft no-cut core zone on the westside and a 30 ft no-cut core zone on the eastside, uncertainty remains concerning:

1. Mortality of buffer trees from wind-throw and other factors,
2. Whether or not the stands will remain on trajectory to DFC targets (westside),
3. Whether or not the stands will remain within desired ranges (eastside), and
4. Whether or not FFR resource objectives and performance targets will be achieved.

Table 14 lists critical questions and identified projects for this program.

Table 14. Type F Statewide Prescription Monitoring Program.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR Type F buffer treatments?	Type F Riparian Prescription Monitoring Project
Do stands remain on trajectory to DFC (Westside) or within desired ranges (eastside)?	
Do riparian functions remain at levels following harvest that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?	
Would alternative approaches to the FFR Type F prescriptions be more effective in meeting FFR resource objectives and performance targets, while reducing costs or increasing flexibility for landowners?	Experimental Type F Buffer Treatment
Are the Type F performance targets valid and meaningful measures of success in meeting resource objectives?	Type F Performance Target Validation Project

Strategy

CMER approved the N/F Riparian Prescription Monitoring study design. It included both Type F and Type N components. The Type F Riparian Prescription Monitoring Project was put on hold until the Type N component is implemented. The Experimental Type F Buffer Treatment Project and the Type F Performance Target Validation Project have not been scoped or designed.

3.1.4 Hardwood Conversion Program

Purpose

The purpose of this program is to inform the FFR strategy for addressing legacy effects of past timber harvest. Many riparian stands in areas where conifer stands formerly occurred are currently dominated by hardwoods as a result of post logging practices and probably won't achieve DFC without active intervention. Large uncertainties exist concerning the identification of locations where hardwood conversion is an appropriate management strategy, the cost and effectiveness of different silvicultural techniques, and the trade-offs between short-term impacts and long-term benefits.

Strategy

Table 15 presents the critical questions and projects of the Hardwood Conversion Program. The program consists of one project, the Hardwood Conversion Project, which is underway. The project is a series of case studies of landowner designed and implemented site-specific hardwood conversions in the stream buffer (within guidelines set by RSAG). Pre- and post-conversion monitoring will document the effects on instream and riparian habitat measures and on regeneration success. In addition, RSAG is contemplating other projects to address aspects of hardwood conversion, such as studies to determine how to identify sites where hardwood conversion is an appropriate management strategy, and to assess the distribution and characteristics of hardwood-dominated riparian stands on FFR lands.

Table 15. Hardwood Conversion Program.

Critical Questions	Project
Where and how should hardwood conversion projects be conducted?	Hardwood Conversion Project
What are the ecological outcomes and economic costs of hardwood conversion?	

3.1.5 Bull Trout Overlay Temperature Program

Purpose

This program addresses the effectiveness of eastside FFR rules in meeting shade and temperature requirements for fish habitat.

Strategy

The Bull Trout Temperature Overlay (BTO) Program consists of three projects that address the critical questions in Table 16. The BTO temperature study is designed to evaluate the effectiveness of both the "all available shade" rule and the standard eastside riparian prescriptions in meeting FFR resource objectives, and to determine if there is a difference in shade and stream temperature provided by the BTO prescriptions and the standard shade requirements. This is a field study that is administered by BTSAG and is currently in the site-selection stage. It is combined with a solar radiation study to evaluate whether "all available shade" is actually achieved under the BTO shade rule. The on-going Groundwater Conceptual Model Project is designed to investigate the potential impacts of timber harvest on groundwater temperatures, which subsequently can discharge to streams and thereby affect the temperature regime of fish habitat. A literature review has been completed and a conceptual model is being developed to identify areas that are highly susceptible to groundwater heating after timber harvest.

Table 16. BTO Temperature Program.

Critical Questions	Projects
Are stream temperatures associated with the Bull Trout overlay shade requirements suitable to meet Bull Trout resource objectives? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature?	BTO Temperature Study
Is "all available shade" actually achieved with the densiometer methodology under the BTO shade rule?	Solar Radiation Project
Does timber harvest affect the temperature of groundwater entering streams?	Groundwater Conceptual Model Project

3.1.6 CMZ Effectiveness Monitoring Program

Purpose

This program addresses two questions:

1. Does the CMZ rule meet FFR resource and functional objectives by:
   a. Protecting the RMZ from breaching as a result of channel migration?
   b. Protecting off-channel aquatic resources?
   c. Providing adequate LWD and shade to the channel?
   d. Maintaining natural levels of sediment input from banks?
2. Are riparian processes and functions being maintained in alternate plans for CMZ protection?
   a. What are the riparian processes and functions provided by the CMZ that must be maintained in alternate plans?
   b. Do riparian functions and processes vary regionally?
   c. What short- and long-term tradeoffs should be considered in the development/approval of alternate plans?

Strategy

Effectiveness monitoring of CMZ functions (Questions 1b through 1d) has a low uncertainty because the rule provides full protection of the CMZ. The uncertainty is greater for the correct delineation of the CMZ and hence the degree of protection provided to the RMZ (Question 1a) and for the effectiveness of alternate plans in maintaining CMZ riparian functions (Question 2). The effectiveness-monitoring program addresses these uncertainties through several projects.

1. CMZ Function Assessment. A literature review of off-channel and riparian functions provided by CMZs.
2. CMZ Integrity Study. A retrospective study of existing CMZs to assess their integrity and the degree to which the RMZ has been impacted by breaching.
3. Alternate-Plan Assessment Study: Monitoring CMZs with alternate plans to assess the degree to which off-channel and riparian functions have been preserved.

3.1.7 Mass Wasting Effectiveness Monitoring Program

Purpose

The purpose of this program is to assess the degree to which implementation of the FFR rules is maintaining the rate of management-induced landsliding at natural background levels. The rules assume that:

1. The administrative process of identifying, reviewing, and regulating forest practices on potentially unstable slopes will maintain a naturally occurring rate of mass wasting following forest practices.
2. Implementation of the unstable slopes prescriptions will achieve the Schedule L-1 Resource Objectives of clean water and substrate and maintain channel-forming processes.
3. Implementation of the unstable slopes prescriptions will meet FFR landscape-scale targets (there are no site-scale targets).

Strategy

The Mass Wasting Effectiveness Program will address the critical question that defines the program: *"Are the mass-wasting prescriptions effective in meeting the performance targets?"* The strategy is to 1) evaluate effectiveness of identifying unstable slopes for applying prescriptions (avoidance or mitigation), and then 2) to evaluate effectiveness at two scales, the

landscape scale (Extensive Monitoring) and the site scale (prescription monitoring). Extensive monitoring will evaluate trends in the number and volume (or area) of landslides over time at the watershed scale using landslide inventory methods similar to those of watershed analysis (see Extensive Monitoring Program). Prescription level monitoring will use a "post-mortem" analysis on a sample of landslides to determine if and how management actions were responsible for triggering the landslide. This will include landslides associated with roads, harvest, and/or leave areas (e.g., windthrow-triggered). We will coordinate the two scales of monitoring by conducting prescription level "post-mortems" within watersheds evaluated in the Extensive Monitoring. This will allow for interpretation of results across multiple scales; i.e., how does the effectiveness (or ineffectiveness) of specific prescriptions contribute to the total effect of landslides at the landscape scale? Table 17 (below) lists critical questions identified for mass wasting effectiveness monitoring and the associated projects.

Table 17. Mass Wasting Effectiveness Monitoring Program.

Critical Questions	Project
Are unstable landforms being accurately and consistently identified in the field?	Effectiveness of Unstable Landform Identification
Are forest practices maintaining natural rates of mass wasting?	Mass Wasting Extensive Monitoring (Landscape-scale Effectiveness Monitoring)
What field protocols will be used for assessing the causal mechanism of landslides at the site scale? Are unstable slope rule strategies failing to prevent landslides, and if so, how?	Mass Wasting Prescription-scale Effectiveness Monitoring
Does wind-throw on mass-wasting buffers (leave areas) increase mass wasting?	Mass wasting buffer Integrity and Wind-throw Assessment

3.1.8 Roads Effectiveness Monitoring Program

Purpose

The purpose of the roads effectiveness monitoring program is to determine the degree to which road prescriptions are effective at meeting performance targets for sediment and water.

Strategy

The effectiveness monitoring program for roads exists at two scales: 1) monitoring at the sub-basin scale and, 2) monitoring at the prescription or site scale. FFR performance targets have been established at the sub-basin scale but not at the prescription or site scale; although provisions were made to develop site-scale performance measures. At the sub-basin-scale, road monitoring assesses the effectiveness of the rule strategy for roads at meeting the FFR performance targets for sediment in run off and hydrologic connectivity. This program assumes that performance targets are correct, which allows the testing of effectiveness against those targets. The goal of this program also meets the intent of the Extensive Monitoring program for roads; therefore, sub-basin scale road performance targets are evaluated within the Extensive Monitoring Program. Because the rules provide for a 15-year implementation window for new road rules, this is a long-term program and results will provide a periodic evaluation of the trend and whether that trajectory is toward meeting the performance targets by 2014.

Prescription, or site-scale, effectiveness monitoring provides more immediate insights into the effectiveness of road prescriptions. Because the FFR prescriptions are tied to implementation of RMAPs, monitoring must also occur within this context. The prescription-scale subprogram requires the development of site-specific road performance measures (based on prescription objectives), the testing of site-level effectiveness using RMAP areas as a sampling stratum, and the development of field protocols for site-scale performance measures. The road prescription effectiveness monitoring program will inform the rules at several levels by determining whether individual RMAPs need to be modified to achieve resource objectives, whether implementation of the rules is attaining the performance targets across ownerships and regions of the state, and if the guidelines and rules for road maintenance and abandonment planning need to be changed.

The road prescription effectiveness monitoring program currently consists of five projects, and Table 18 relates the program's projects to critical questions. Two tools or methods need development to support the monitoring program. Two projects revise and validate an analytical model to estimate road-surface erosion (the Watershed Analysis road surface erosion model) needed to estimate sediment contributions from selected road segments and road systems. This model and these projects are also common to the Extensive Road Monitoring program. While the prescription monitoring focuses on the effectiveness of prescriptions applied to targeted sites and locations, the first project listed in Table 18 asks if we are first correctly targeting the appropriate locations to fix according to the priorities established in the rules.

Table 18. Road Prescription Effectiveness Monitoring Program.

Critical Program Questions	Projects
Are RMAP scheduled activities identified and prioritized appropriately?	Effectiveness of Identifying RMAP Priority Fixes
Are field or analytical methods needed to support the monitoring program?	Road Surface Erosion Model Update Development of site-scale field protocols
Are prescriptions effective in meeting site-scale performance targets?	Road Prescription Effectiveness Monitoring design and pilot project
How accurate is the road surface erosion model in predicting short and long term road sediment from run off at the site scale?	Road Surface Erosion Model Validation/ Refinement

3.1.9 Fish Passage Effectiveness Monitoring Program

Purpose

This program is designed to address uncertainties in the WDFW hydraulic code rules, associated barrier-assessment manual, and road maintenance and abandonment plans that may decrease the effectiveness of fish passages at forest road-crossing structures (Table 19).

Table 19. Fish Passage Effectiveness Monitoring Program.

Critical Questions	Project
Does the RMAP process correctly identify the stream crossing structures that impede fish passage? Are the corrective measures effective in restoring fish passage?	Fish Passage Effectiveness Monitoring Project

Strategy

Currently one effectiveness monitoring project is proposed to address the critical questions. This project is currently being scoped by ISAG.

3.1.10 Forest Chemicals Program

Purpose

The purpose of this program is to address uncertainty concerning the effectiveness of the chemical application rules in protecting water quality and vegetation in riparian and wetland buffers. Alterative strategies with lower costs will also be considered.

Strategy

The program is under RSAG. Scoping has not occurred and no projects have been identified.

3.1.11 Wetlands Re-vegetation Effectiveness Monitoring Program

Purpose

This program addresses uncertainty concerning the re-vegetation of forested wetlands following timber harvest.

Strategy

A literature review of forested wetlands is being completed for transmission to SRC review (Table 20). A pilot project to evaluate methods for determining reforestation in forested wetlands is underway.

Table 20. Wetlands Revegetation Effectiveness Monitoring Program.

Critical Questions	Project
Are forested wetlands regenerating sufficiently to maintain wetland functions?	Forested Wetlands Literature Review Project

3.1.12 Wetlands Mitigation Program

Purpose

This program addresses the effectiveness of measures mitigating the effects forest road construction on wetlands.

Strategy

This program is administered by WETSAG. Scoping has not occurred and no projects have been identified.

3.1.13 WMZ Effectiveness Monitoring Program

Purpose

This program will be designed to assess the effectiveness of Wetland Management Zones in meeting FFR resource objectives and performance targets. The wetland management zone rules are based on a number of assumptions, including:

1. Meeting the wetland performance targets will achieve the functional objectives.
2. Certain BMPs work better than others.
3. We can determine how effective BMPs are (to a generalized degree). We can standardize how we measure and document this effectiveness.
4. Reaching BMP objectives at the site scale (i.e., avoiding road fill in wetlands) will aggregate to meeting sub-basin and watershed scale functional objectives.

These uncertainties form the basis for the critical questions (Table 21) that the program will be designed to address.

Table 21. WMZ Effectiveness Monitoring Program.

Critical Questions	Project
Are current WMZs effective in providing adequate levels of LWD? Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids? Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect stream temperatures in connected streams? Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	Undefined

Strategy

The program is under WETSAG. No projects are currently proposed. Scoping to develop a strategy has not occurred.

3.2 EXTENSIVE MONITORING PROGRAMS

Extensive monitoring evaluates the current statewide status and future trends of key watershed input processes and habitat conditions across FFR lands. Extensive monitoring is a landscape-scale assessment of the effectiveness of FFR rules to attain specific performance targets. This is different from prescription effectiveness monitoring, which evaluates the effect of specific prescriptions at the site scale. Extensive monitoring is designed to provide annual or periodic report-card-type measure of rule effectiveness (i.e., do we meet the performance targets or how much have we improved over time) that can be used to by the regulatory agencies to determine if progress is consistent with expectations. Several extensive monitoring components were identified in the MDT report. CMER has identified several extensive monitoring programs, but further scoping and project design is needed, as well as CMER review and approval.

3.2.1 Extensive Riparian Trend Monitoring Program

Purpose

The purpose of this program is to obtain an unbiased estimate of the distribution of stream temperature and riparian stand conditions relative to LWD recruitment potential across FFR lands by physiographic region. The proportion of stream miles currently meeting water quality standards will be documented and landscape-scale trends in water temperature and riparian stand conditions will be tracked over time. This information will be used to evaluate the landscape-scale effectiveness of the FFR riparian prescriptions in moving streams towards desired future conditions (meeting water quality standards) on a statewide scale.

Strategy

The program will be implemented in two components, a Type N component and a Type F component. The current strategy is to begin sampling with the Type N streams. A random sample of sites on the Type N stream network will be selected for each eco-region. Summer temperature data will be collected at each site and the condition of riparian vegetation will be characterized using remote sensing and/or field methods. The products will be frequency distributions characterizing the range of stream temperature and riparian stand condition for Type N streams on FFR-managed lands for each forested eco-region. The proportion of Type N stream miles currently meeting water quality standards will be documented. As iterative sampling occurs, regional trends in the distribution of stream temperature and riparian stand conditions will be reported.

3.2.2 Extensive Fish Passage Trend Monitoring Program

This program will be designed to evaluate status and trends in fish passage conditions at forest road crossings. A draft study design was developed as an attachment to the MDT report and is currently under review by ISAG.

3.2.3 Extensive Mass Wasting Trend Monitoring Program

Purpose

This program will be designed to test the effectiveness of landscape-scale mass wasting performance targets. Evaluation of these performance targets can only be achieved by evaluating landslide rates and sediment delivery over watershed or larger areas and over a time period sufficient to test management influences over mass wasting.

Strategy

Prescription or site-scale effectiveness monitoring of mass wasting prescriptions will be nested within the areas monitored for extensive or landscape scale monitoring. It includes an analysis of wind-throw as a cause of failures in mass wasting buffers. There are currently two competing and/or complimentary monitoring designs for extensive monitoring for mass wasting under consideration by the UPSAG. Evaluation of these designs from current and planned pilot projects is expected to be completed in 2004.

3.2.4 Roads Extensive Trend Monitoring Program

Purpose

Data collected at the extensive monitoring scale are used to determine status and to monitor trends for key indicators of road performance. Road monitoring assesses the effectiveness of the rule strategy for roads at meeting the FFR sub-basin-scale performance targets for sediment in run off and hydrologic connectivity. The main purpose of this monitoring component is to provide data that can be used to assess if performance targets, and therefore resource objectives, are being met throughout the state. The intent is to track important yet easily and consistently measured road indicators through time. Data from the extensive network of sites will be used to draw conclusions about statewide trends.

Strategy

This program assumes that performance targets are correct, which allows the testing of effectiveness against those targets. The goal of this program also meets the intent of the Extensive Monitoring program for roads; therefore, sub-basin scale road performance targets are evaluated within the Extensive Monitoring Program. Because the rules provide for a 15-year implementation window for new road rules, this is a long-term program and results will provide a periodic evaluation of the trend and whether that trajectory is toward meeting the performance targets by 2014. Randomly selected blocks of roads within areas covered by forest practices rules will be sampled for estimated sediment delivery to streams and hydrologic connectivity. A literature review is planned to evaluate the state of knowledge on the hydrologic effects of roads at all scales.

3.2.5 Extensive Wetlands Trend Monitoring Program

The wetlands extensive monitoring program will assess the status and trends of reforestation of forested wetlands harvested under FFR rules. No projects are currently proposed. Scoping to develop a strategy has not occurred.

3.3 INTENSIVE MONITORING PROGRAMS

Intensive monitoring is a watershed-scale research program that is designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and the biological effects of FFR on aquatic resources. The evaluation of cumulative effects of multiple management actions on a system requires an understanding of how individual actions influence a site and how those responses propagate through the system. This understanding will enable the evaluation of the effectiveness of management practices applied at multiple locations over time. This sophisticated level of understanding can only be achieved with an intensive, integrated, monitoring effort. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how system biology responds to these habitat changes. This program was identified in the MDT report as an essential component of an integrated monitoring program. The scientific advisory groups have identified several research topics that appear suitable to include as part of an intensive monitoring program. Further scoping is underway to identify critical questions and hypotheses for intensive monitoring. The topics that have been identified to date are presented briefly below.

3.3.1 Aquatic Habitat-Biotic Response Validation

The purpose of this project is to validate aquatic habitat and biotic response to changes in inputs and watershed processes associated with forest practices. The project will improve understanding of causal relationships, validate FFR performance targets or suggest alternatives, and inform management prescriptions.

3.3.2 Downstream Water Quality/Fish Response

The purpose of this project is to address critical questions concerning the effects of the Type N strategy on export of sediment, LWD, heat and nutrients from the Type N stream network and the effects of those changes on downstream fish and water quality in Type F streams. The critical questions are:

- Is the Type N riparian strategy effective in maintaining downstream fish habitat and harvestable fish populations?
- How does the Type N strategy affect exports of heat, LWD, nutrients and sediment from the Type N network over time following harvest?
- Does the strategy identify and protect sites that are important for maintaining appropriate exports of LWD, sediment, nutrients and water temperatures?
- How does the habitat and productivity of salmonids and SAAs respond to changes in exports resulting from harvest in the Type N network?

This project has not been scoped yet. However, there are potential links between this project and the Type N experimental buffer effectiveness study. Future scoping would address the feasibility and practicality of linking these studies.

3.3.3 Mass Wasting Target Validation

The purpose of the mass wasting target validation project is to validate mass wasting performance targets by determining what levels of cumulative sediment inputs are harmful to aquatic resources at the basin scale.

3.3.4 Road Performance Target Validation

The purpose of the road performance target validation project is to assess the validity of the basin-scale performance targets for road sediment by determining what levels of cumulative sediment inputs are harmful to aquatic resources at the basin scale.

3.4 RULE IMPLEMENTATION TOOL PROGRAMS

Rule implementation tool programs/projects are designed to develop, refine or validate tools used to implement the forest practices rules. Two types of rule-tool projects are recognized:

1. Methodology Tool Development Projects develop, test or refine protocols, models, and guides that allow the identification and location of FFR specified management features, such as the Last Fish Model, various landslide screens, the Np/Ns break and SAA Sensitive Site Identification.

2. Target Verification Projects consist of studies designed to verify the validity of performance targets developed during FFR negotiations that the authors identified as having a weak scientific foundation, such as the DFC basal area targets.

Rule implementation tools differ from research and monitoring tools, which are required to implement a specific effectiveness-monitoring program, such as Road Surface Erosion Model. Monitoring implementation tools are included with the effectiveness monitoring programs.

CMER identified nine rule tool implementation programs consisting of 19 projects.

3.4.1 Type N Delineation Program

The purpose of this program is to validate and refine methodologies for identifying the perennial initiation point (upper extent of perennial flow in Type N streams). The program is administered by UPSAG. The pilot project is currently near completion.

Perennial Stream Survey Pilot

The purpose of this pilot project is to produce a field methodology for identifying the break between seasonal flow (Ns streams) and perennial flow (Np streams), provide an initial assessment of the accuracy of the default basin area numbers, and develop an estimate of the sample size needed to achieve precision and accuracy objectives based on variability in basin size in PIP locations.

Perennial Stream Survey Statewide

A statewide project that will develop a refined default basin area and one or more field criteria that can be used to identify the Np/Ns break in the field (assuming that basin area is validated as a good surrogate). Design and implementation of this project is contingent on the results of the pilot project and policy direction.

3.4.2 Sensitive Site Program

This program consists of two rule-tool implementation projects. Work on the program began in 1999. It is managed by LWAG.

SAA Sensitive Site Identification Method Project

Purpose

The purpose of the SAA sensitive site identification method project is to develop a practical methodology for identifying SAA sensitive sites, such as headwall seeps, side-slope seeps, and headwater springs. It is designed to answer the following critical questions:

1. Are sites important to amphibians correctly identified by rule?
2. Are rule-identified sites valuable for amphibians?
3. Does sensitive site field identification need to be improved?

It is intended to inform the Type N riparian rule by providing a standard methodology (field guide) for field managers to identify SAA sensitive sites when designing harvest units.

Strategy

This project is currently underway and is being administered by LWAG.

SAA Sensitive Sites Characterization

Purpose
The purposes of this project are to document the distribution and characteristics of sensitive sites as described by the FFR rule and to verify their utilization and habitat value for SAA. It will generate information on the characteristics of sensitive sites, validate the extent to which they are utilized by amphibians, and determine if other sensitive sites exist.

Information from this project could result in changes to the sensitive area criteria in the rules to better focus buffer protection on areas important to SAA.

Strategy
This project is currently underway and is being administered by LWAG.

3.4.3 Stream Typing Program

This program is administered by ISAG and DNR Forest Practices Division staff.

Last Fish/Habitat Prediction Model Project

Purpose
The purpose of this project is to develop a GIS-based logistic regression fish habitat model(s) to identify and map the upper boundary of Type F (fish-bearing streams). This project will inform the stream-typing rule by providing the consistent, statewide mapping system required by the FFR agreement.

Strategy
This project is currently underway. A preliminary model for western Washington is nearly completed, and work on eastern Washington is scheduled to begin in late 2003.

3.4.4 Type F DFC Validation Program

The purpose of this program is to address issues related to validation of the western Washington DFC performance targets. The program is being administered by RSAG.

DFC Target Validation Project

Purpose
The purpose of this project is to determine the degree to which the current DFC targets adequately describe the conditions found in mature riparian stands. This nearly completed project is administered by RSAG.

DFC Trajectory Model Validation Project

Purpose
This project will assess the accuracy of the DFC model in predicting riparian stand growth and trajectory from harvest age to the DFC target (age 140). This project will be designed to validate

the DFC model as a tool to predict trajectory to the DFC target for both conifer-dominated and mixed stands. A study design has not been developed for this project.

DFC-Aquatic Habitat Project

Purpose

The purpose of this project is to determine the range of aquatic habitat associated with mature (DFC) riparian forest conditions. A study design for this project has not been developed.

Eastside Type F Temperature Project

Purpose

The purpose of this project is to update and validate the shade-elevation-stream temperature relationships in the eastside temperature requirements nomograph. This project is currently underway and is being administered by SAGE.

3.4.5 Bull Trout Habitat Identification Program

This program is administered by BTSAG and consists of two projects.

Bull Trout Presence/ Absence Protocols

This active project is developing a set of protocols for assessing the presence of Bull Trout.

Bull Trout Habitat Prediction Models

This project will be designed to improve the accuracy of the method used to identify Bull Trout habitat for forest management purposes.

3.4.6 CMZ Delineation Rule-Tool Program

This program will develop materials and procedures to aid field managers in the consistent and accurate delineation of CMZs. The program is being administered by UPSAG. It consists of two projects.

CMZ Screen and Aerial Photograph Catalog Project

This GIS-based project will be designed to identify potential CMZs based on slope and valley width data and to overlay on this map the historic DNR aerial photographs documenting past migration behavior.

CMZ Boundary Identification Criteria Project

This project will be designed to develop criteria and a consistent and uniform method to define the margins (edges) of the CMZ.

3.4.7 Unstable Landform Identification Program

This program consists of five projects that provide statewide information on the distribution of unstable landforms. The management strategy for regulating forest practices on unstable slopes consists primarily of an administrative process for identifying and reviewing forest practices on potentially unstable slopes. The main elements include defining and screening unstable slopes and improvements to the State Environmental Protection Act (SEPA) process. The success of

the management strategy for unstable slopes is dependent on our ability to recognize potentially unstable slopes in order to avoid or mitigate the hazards posed from operating on these landforms. The projects in this program are specifically referenced in the FFR as necessary for implementing forest practices that meet resource objectives. This program is administered by UPSAG.

Shallow Rapid Landslide Screen for GIS

The first phase of this project developed a GIS-based screen of modeled slope stability based on DEM topography for the westside. A second phase to identify topographic model(s) appropriate for similar mapping on the eastside is likely to be superceded by the recently approved Landslide Hazard Zonation Project. The westside screen becomes one component of the Landslide Hazard Zonation (LHZ) project in areas where the landslide hazard zonation will be completed.

Technical Guidelines for Geotechnical Reports

This project develops technical guidelines for geotechnical reports used in the SEPA review process. The guidelines will include identification of appropriate analytical tools and techniques appropriate for different projects and at different scales. The guidelines would replace a draft version currently available through DNR.

Regional Unstable Landforms Identification (Map/Deep-Seated Landslide Screen)

This active project provides a coordinator to work with TFW cooperators within each DNR region in order to identify unstable landforms that do not meet the present statewide landform descriptions. The project also serves as an interim screen for deep-seated landslides by identifying lithologies that promote deep-seated landslides; however, it is not intended to map them.

Landslide Hazard Zonation

This is a multi-phase project. A completed phase has collected and collated Watershed Analyses including information on unstable landforms and placed this information in a GIS-compatible database. A currently active phase is developing a statewide standard for assigning hazard to unstable slopes. The proposed last phase will provide consistent interpretation of aerial photographs of unstable landforms in high priority areas that are not covered by Watershed Analyses and are within FFR jurisdiction.

Accuracy and Bias in Identification of Unstable Landforms

This project will be designed to assess the ability of forest practitioners to accurately and consistently identify unstable landforms in the field

3.4.8 Glacial Deep-seated Landslide Program

The Glacial Deep-seated Landside Program addresses the need for a tool to assess the failure potential of deep-seated landslides resulting from changes in groundwater hydrology due to timber harvest in recharge areas. This program consists of two projects and is administered by UPSAG.

Model Evapo-Transpiration Deep-Seated Landslide Recharge Areas

This completed project developed an analytical model for assessing the evapo-transpiration changes resulting from timber harvest in deep-seated landslide recharge areas. The model

demonstrated that harvest does provide additional recharge to the landslide during the winter months.

Method to Assess Vulnerability of Deep-Seated Landslides to Timber Harvest

This project will integrate the existing analytical model with site-specific slope stability analysis to develop a site-specific assessment methodology that determines the potential for failure of deep-seated landslides subject to harvest in the recharge area.

3.4.9 Wetland Tool Program

This program consists of two projects and is administered by WETSAG.

Hydro-geomorphic Wetland Classification System

This project will be designed to identify hydrologic and geomorphic criteria to aid in the classification of wetlands.

DNR GIS Wetlands Data Layer

This project will be designed to develop a GIS data-layer based on physical properties utilizing the hydro-geomorphic classification system.

4.0 PROGRAM RANKING AND PRIORITIZATION

4.1 INTRODUCTION

This chapter describes the ranking process used by CMER to assess the relative importance of proposed programs in meeting FFR goals and objectives. The purpose of the ranking and prioritization is to focus CMER's effort on critical areas. This is an important step because over the near-term the proposed research and monitoring projects exceed the availability of funding and the capabilities of human resources. Establishing priorities will allow CMER to pursue research and monitoring objectives in an orderly manner over time. CMER's list of ranked projects determines the direction and progress of adaptive management.

CMER's strategy for ranking and prioritizing its work is based on discussions with the FFR policy committee, the group with oversight responsibility for reviewing CMER priorities and budget. The approach that was decided upon was to:

1. Rank at the program level (as opposed to the project level)
2. Provide a separate ranking of effectiveness/validation monitoring programs on the basis of scientific uncertainty and risk to aquatic resources;
3. Provide a separate ranking of extensive trend monitoring programs on the basis of scientific uncertainty and risk to aquatic resources;
4. Determine the importance or priority of individual projects within a program on a case by case basis;
5. Consult with DNR on ranking of rule tool programs, with DNR taking the lead
6. Proceed with scoping of the intensive monitoring program.

This section presents CMER's rankings and prioritization of effectiveness/validation and extensive trend monitoring programs. The FFR Policy committee has reviewed and accepted the rankings presented herein. Consultation with DNR on their ranking of rule tool programs is underway but has not been completed.

4.2 RANKING SYSTEM

4.2.1 Ranking Criteria

The ranking approach applied to effectiveness/validation and extensive trend monitoring programs was designed to assess the merit of each program by asking two questions:

1. How certain are we of the science and/or assumptions underlying the rule?
2. How much risk is there to the protected resource if the science and/or assumptions underlying the rule are incorrect?

In an attempt to obtain a uniform set of scores, the ranking approach constrains subjectivity by carefully defining the two assessment criteria and by establishing a numerical evaluation scale for each criterion. The sum of the assessment scores summarizes the project's importance.

The ranking process is firmly rooted in the FFR. The rules established during the FFR negotiations are based on science and certain assumptions as to the application of the known science to the forest practice. The authors understood that uncertainties and gaps existed in the scientific foundation of the rules and that consequently some of the underlying assumptions contain uncertainties. CMER was charged with reducing these uncertainties through effectiveness and validation monitoring and research and then recommending modifications to the rules as necessary through the adaptive management process.

Criterion 1. Uncertainty

Scientific uncertainty is defined by the following statement:

How much is NOT known about the science and the assumptions on which the rule is based?

Uncertainty is a measure of confidence in the science underlying a rule, including the scientific relationships providing the conceptual foundation for the rule, the assumptions incorporated into the prescription, or the response to the prescription when it is applied on the ground. High uncertainty (low certainty) indicates that little is known about the underlying science and the rule is likely based on speculation and poorly informed assumptions. It may also indicate that the prescription treatment is untested, and the performance under field conditions is unknown. Low uncertainty (high certainty) indicates that the science underlying the rule is well known and accepted, or that the prescription (or similar treatments) has already been evaluated under similar conditions.

Examples:

High Uncertainty: Few studies describe the factors controlling the initiation of perennial flow in headwater streams, and the rule is based on assumptions derived from limited data. No studies have been done of the Type N patch buffer system (clear-cut strategy) relative to buffer survival or riparian functions.

Low Uncertainty: Numerous studies describe the effects of forest practices on slope stability and the unstable-slope rules have a firm scientific/technical foundation. (This firm foundation does not necessarily imply that all aspects of the unstable-slope rules have a similarly firm scientific foundation.)

Criterion 2: Risk

Risk to FFR resources is defined by the following statement:

What is the potential impact on FFR resources if the rule is flawed?

A flawed rule has the potential for detrimentally impacting aquatic resources and thus undermining the intent of the FFR goals, e.g. harvestable fish populations, stream associated amphibians, and water quality. A high-risk assignment indicates the rule component under study has a greater potential to alter the resource because of its high magnitude, frequency, and/or direct linkage to the resource. A low risk assignment indicates that the rule component has a lesser potential to alter the resource because of its low magnitude, frequency, and/or indirect linkage to the resource.

High Risk: Mass wasting is the major contributor of sediment to forest streams. Increased rates of mass wasting from forest practices can have a high impact on critical salmon and amphibian habitat, and thus the unstable slopes rule has a high risk ranking.

Low Risk: The Type F riparian prescriptions require a minimum leave tree requirement in the outer zone, however because of the small number of trees and their distance from the stream, there is only limited risk to riparian functions and aquatic resources from thinning in the outer zone.

4.2.2 Scoring System

The range of scores for each criterion is 1 (lowest) through 5 (highest). To increase scoring consistency the high (5), medium (3) and low (1) scores were defined for each criterion. The intervening scores (i.e. 2 and 4) allow for a more refined estimation of value or as a vehicle to resolve uncertainties.

4.2.3 Ranking Process

Effectiveness/validation and extensive trend monitoring programs were ranked using the system describe above by CMER members in attendance at the December 19, 2002 CMER meeting. The individual scores were averaged to obtain a mean score for risk and a mean score for uncertainty for each program. The mean risk and mean uncertainty scores for each program were multiplied to get a combined score, and programs were ranked on the basis of the combined scores.

4.3 PROGRAM RANKING RESULTS

This section presents the results of the CMER ranking process.

4.3.1 Effectiveness/Validation Programs

The rankings for the 16 effectiveness/validation programs are presented in Table 22, along with the mean uncertainty and risk scores.

Table 22. CMER rankings for effectiveness/validation programs.

Overall Ranking	Program Title	Uncertainty		Risk	
		Mean Score	Rank	Mean Score	Rank
1	Type N Buffer Characteristics, Integrity Function	4.4	1	3.9	1
2	Eastside Type F Desired Future Range and Target Development	4.2	2	3.8	2
3	Type N Amphibian Response	4.2	2	3.7	3
4	Road Basin-scale Effectiveness Monitoring	3.4	5	3.4	4
5	Type F Statewide Prescription Monitoring	3.2	7	3.1	6
6	Mass Wasting Effectiveness Monitoring	3.2	6	2.9	8
7	Eastside (BTO) Temperature	3.0	9	3.2	5
8	Wetlands Revegetation Effectiveness	3.5	4	2.7	11
9	Road Site-scale Effectiveness Monitoring	2.6	14	3.1	6
10	Hardwood Conversion	3.0	8	2.6	12

Overall Ranking	Program Title	Uncertainty		Risk	
		Mean Score	Rank	Mean Score	Rank
11	Wetland Mitigation	2.8	11	2.7	10
12	Fish Passage Effectiveness Monitoring	2.6	14	2.9	9
13	Wildlife Program	2.9	10	2.4	14
14	Wetland Management Zone Effectiveness Mon.	2.8	12	2.5	13
15	CMZ Effectiveness Monitoring	2.7	13	2.1	15
16	Forest Chemicals	2.0	16	2.1	16

4.3.2 Extensive Trend Monitoring Programs

The rankings for 3 extensive trend monitoring programs are presented in Table 23, along with the mean uncertainty and risk scores. The extensive roads monitoring program was inadvertently left out of the ranking process. Based on the rankings for the Road Basin-scale Effectiveness Monitoring program (Table 22), we assume the extensive roads program would have ranked in between the extensive riparian and extensive mass wasting programs.

Table 23. CMER rankings for extensive trend monitoring programs.

Overall Ranking	Program Title	Uncertainty		Risk	
		Mean Score	Rank	Mean Score	Rank
1	Extensive Riparian Monitoring	3.5	2	3.5	1
2	Extensive Mass Wasting Monitoring	3.7	1	2.9	3
3	Extensive Fish Passage Monitoring	3.1	3	3.1	2
Not ranked	Extensive Roads Monitoring	Not ranked			

4.3.3 FFR Policy Group Approval

The CMER rankings for effectiveness/validation and extensive monitoring projects were presented to the FFR Policy Group at their January, 2003 meeting. The FFR Policy Group accepted the rankings and instructed CMER to use them as the basis for prioritizing effectiveness/validation and extensive trend monitoring projects.

5.0 BUDGET

The work plan budget is available under separate cover from the CMER Adaptive Management Administrator (Geoff McNaughton, geoffrey.mcnaughton@wadnr.gov). The budget is organized by task category and by fiscal year. Because the monitoring program is dynamic, the budget is updated on a routine basis.